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RESEARCH ARTICLE

AN EXPERIMENTAL STUDY TO ASSESS THE EFFECTIVENESS OF APPLE CIDER VINEGAR ON SERUM CHOLESTEROL LEVEL IN PUNE CITY.

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Abstract

Background: Obesity is one of the major health problems now days. It is not always necessary that if the person is not obese, the serum cholesterol level is normal. Various interventions are available now days including dietary supplements which claim to reduce serum cholesterol level.

Methods: An experimental study has done on 40 samples (20 experimental and 20 control) selected randomly in Pune city, India. Apple cider vinegar (oral) therapy was given to experimental group for the duration of 4 months from January, 2017 to April, 2017. Confounding variables were controlled by selecting homogeneous sample of males and who were regularly going for morning walk daily (both experimental & control). T-test was used to compare experimental and control group. Chi-square test was used to determine the association between socio-demographical variables and observed data.

Results: Independent T-Test results showed that there is significant difference between the experimental group and control group ($p < .005$). Chi-square shows significant association between age, BMI and the serum cholesterol level ($p = .002$).

Conclusion: Results showed that regular intake of apple cider vinegar empty stomach in morning and before each meal helps to reduce total cholesterol level as well as LDL level.

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Introduction:-

“An apple a day keeps doctor away” was truly said once.

Apples are the healthiest food that a person can eat. They are high in fiber rich in vitamin C, they are low in calories. They have only trace of sodium and no fats or cholesterol. Apples have a great property as antioxidants as it is high in polyphenols. It's not only about the functions it has shown great benefits like, it mitigates the effects of asthma and Alzheimer's diseases, while assisting with weight management, bone health, pulmonary functions and gastrointestinal protection.

Apple cider Vinegars is known for its best of vinegar as the main effect of it is to help to get rid of the fats around the liver. When it is consumed it has gentle effect on the digestive tract as compared to the other forms of the vinegar. It has also got the special ability to breakdown the fats over a period of time and that will help in easy and healthy functioning of the kidneys bladder and liver. The apple cider vinegar has acidic properties which will reduce the irritability and inflammation of the liver. Study reveals the importance of BMI as a nutrition assessment.

The excess of fats in liver can cause Fatty liver which causes enlargement and swelling of liver where the metabolism is poor and can lead to heart disease too it is possible for us to get rid of the fatty liver by having dietary modification adding plant-based diet, and whole grains. Adding on the plant-based diet; exercise will help to control your cholesterol and triglycerides. Along with its consumption of the apple cider vinegar will definitely show the results of reducing the risk for complications.

Review of literature:-

A high intake of food derived from plants such as fruits and vegetables can prevent cardiovascular diseases. Fruits are also rich in antioxidants which delays ageing and help in lowering cholesterol level¹. Because fruits and vegetables have a high water and fiber content, they're low in calories relative to their volume. Consuming them on a regular basis can result in a higher volume of food intake. Since humans consume a consistent volume of food, a high consumption of low calorie density foods can help to control overall food intake and manage body weight. These natural plants are rich in polyphenols and fiber and are effective in preventing cardiovascular disorder. Apples are one of them rich in polyphenols and its vinegar helps to reduce cholesterol level²

Epidemiological studies reveal that frequent apple consumption reduces the risk of chronic pathologies such as cardiovascular disease, specific cancers, and diabetes^{3,4}. Studies also proved that apple intake may positively affect lipid metabolism, reduce body weight⁴, patency of blood vessels and inflammation. It is said that an apple a day keeps doctor away is proving right as apples are rich in pectin which are rich soluble fibers which it has been demonstrated are effective in lowering cholesterol levels. Real value of apple lies in its organic compounds not only compounds but it is a good source of dietary fibers which provides about 12% of daily fiber requirements.

A mixture of apple cider vinegar and olive oil over the salad dressing used in the Mediterranean diet is proved to reduce the chances of diabetes, have glucose-lowering capacity and minimizes the chances of heart attack by lowering the cholesterol level⁵. Recent studies indicate that apple cider vinegar improves insulin sensitivity also⁶. Blood sugar control is essential for patient with diabetes, and the polyphenols in apples have been reducing the uptake of carbohydrates by the body, this in turn reduces the fluctuation of blood sugar levels in bloodstream. The polyphenols also lower glucose absorption in our digestive tract, and they stimulate insulin in pancreas. And finally polyphenols stimulate the insulin receptors on cells throughout body, which removes the sugar from bloodstream and gets it to cells, which needs it for metabolism and proper organ function.

Apple cider vinegar has anti-glycemic effect and help to block the digestion of some starch; it also helps to keep the blood sugar levels on an even keel. Making sure that the sugar is balanced which incredibly influences the good health. The mechanisms by which apple cider vinegar reduces glucose levels are still unclear. Apple cider vinegar delay gastric emptying in healthy individuals⁶ and in diabetes clients⁴. Apple cider vinegar suppresses the absorption of disaccharides in the small intestine and suppress the enteral carbohydrate absorption⁶. Also apple cider vinegar ingestion before sleep shown to decrease fasting glucose levels in diabetes client⁷. Apple cider vinegar reduces glycolysis and promotes glycogen synthesis by reducing xylose 5-phosphate accumulation in the liver and phosphofructokinase-1 activity in muscle⁸

In general people with fatty liver disease have no symptoms, especially in the beginning; however, some people may experience abdominal discomfort, fatigue and loss of appetite. These people may show symptoms like general feeling of being unwell and vague discomfort. This is why the proper diagnosis is important. Studies also showed that apple cider vinegar also decreases circulating lipid profile⁸ and prevent fatty liver by reducing the chances of lipid accumulation in liver and skeletal muscle. The apples are rich in polyphenol which is an oligomers and polymers of flavanols and composed of epicatechin units⁹. Small peel of apple contains high levels of phenolics and flavonols¹⁰. Compound. Polyphenols have oxidative properties which helps to reduce the bad cholesterol¹¹. Cloudy apple juice on the other hand may maintain an important polyphenol amount due to anaerobic conditions and the lack of the clarification step¹².

Apple cider vinegar have incredible benefits skin needs it, heart needs it, and even colon needs it. One of the widely known benefits is its ability to regulate cholesterol. Apple cider vinegar is a full source of vitamin C and it has phosphorus and copper. It also acts as an anti-oxidant. It lowers the bad cholesterol and monounsaturated fatty acid will elevate the good cholesterol. Apple cider vinegar along with Almonds is nutritionally rich in omega 3.¹³ According to Department of Agriculture, USA, 100 g of raw, unroasted almonds provides 579 kcal, 50 g of fat, 13 g of insoluble dietary fibre and 21 g of protein 14 and 9 g of PUFA, 36 g of MUFA and 5 g of SFA.¹⁴ A study shows effects of almond oil on fasting blood lipids among 27 strata. Study shows that almond regular intake of 2 to 5 gm of almond oil helps in reducing the cholesterol level by 60%¹⁵.

Apple cider vinegar help in reducing the cardio vascular risk factors, including fasting and postprandial glucose, insulin resistance¹⁶ and insulin secretion¹⁷. Daily intake of apple cider vinegar reduces the WC within the context of a weight-loss intervention and with a 9% decrease with an isocaloric, complex carbohydrate control diet¹⁸. Apple cider vinegar along with food as a daily snacks affects the cardiac markers, such as lipoprotein metabolism and body composition and improves heart health. It is also said to consume the overnight apple cider vinegar for the better health effect. The apple cider vinegar not only give use the better cholesterol level but also it reduces the risk for heart disease. It is shown in many researches that consumption of apple cider vinegar gives favorable plasma proteins and reduces the risk for heart disease.

Dietary pattern of each individual is different in each individual; it is affected by life style changes, diet. This is also has to do with the high unsaturated high fatty acids and vitamin C apple cider vinegar helps the oxygen and nutrient to flow freely in blood. Adding apple cider vinegar in your diet will definitely give good health effect such as body weight reduction and anti-inflammatory properties. Study conducted by Estruch¹⁹, Experimental group receives 1.5oz of apple cider vinegar per day and control group received same diet with a single, calorie-matched food. Results revealed that experimental group showed improvement in lipids, lipoproteins, and apolipoproteins levels and decrease abdominal adiposity in adults with elevated LDL-C. The LDL-C-lowering effect of apple cider vinegar has been reported in previous trials in hypercholesterolemic and normocholesterolemic individuals²⁰.

Vitamin D has vital role in for the cause of cardiovascular disease, low vitamin D cause risk for cardiovascular disease. Fat soluble vitamin D has found in very few foods; it can be added to the supplementary dietary products. Instead of which the apple cider vinegar which provides vitamin C, Magnesium and copper reduces the risk for heart disease will definitely prove great change. Apple cider vinegar has unique fat reducing property by accelerating lipolysis makes almond a cardio protective agent. Griebel al²¹ reported that lipid-lowering effects of apple cider vinegar extend beyond the fatty acid profiles.

Objectives:-

1. To assess the effectiveness of apple cider vinegar on serum cholesterol level.
2. To compare the serum cholesterol level and LDL after apple cider vinegar therapy.
3. To determine the association between socio demographical data with observed serum cholesterol level.

Hypothesis:-

H₀:- There is no significant difference between the serum cholesterol level of experimental and control group.

Methodology:-

The research approach used for this study was experimental approach with pretest-post test only design. Sample was selected randomly (20 experimental and 20 control). Both the groups were undergone pretest and then the post test of both experimental and control group was compared by using t-test, to assess the effectiveness of apple cider vinegar therapy. Data were collected by collecting the blood lipid profile of all subjects (Fasting).

Results:-

Part- 1 Sample characteristics:-

Table 1:-Frequency, percentage and cumulative percentage of men according to their AGE N= 20 (EXPERIMENTAL GROUP).

Age in years	Frequency	Percent	Valid Percent	Cumulative Percent
18	1	5.0	5.0	5.0

	20	2	10.0	10.0	15.0
	21	1	5.0	5.0	20.0
	29	1	5.0	5.0	25.0
	31	1	5.0	5.0	30.0
	32	1	5.0	5.0	35.0
	34	2	10.0	10.0	45.0
	36	1	5.0	5.0	50.0
	38	1	5.0	5.0	55.0
	39	2	10.0	10.0	65.0
	41	1	5.0	5.0	70.0
	44	1	5.0	5.0	75.0
	54	1	5.0	5.0	80.0
	56	1	5.0	5.0	85.0
	62	2	10.0	10.0	95.0
	68	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 1 depicts:-Majority of subjects (84%) were in age group of 30-40 years, and 10% were in age group of 41-50 years and only 6% were having age more than 50 years.

Table 2:-t-test score of total cholesterol for experimental and control group, N= 40(Post test comparison of Experimental and Control group).

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
EXPERIMENTAL (cholesterol) CONTROL (cholesterol)	9.000	6.325	1.414	6.040	11.960	6.364	19	.002

Table 2:-Depicts that at 5% level of significance the t-test value is 6.364 at degree of freedom 19, which is less than tabled value, so we reject the null hypothesis. Hence the results are significant (p=.002). It means the serum cholesterol values decrease after regular consumption of apple cider vinegar in experimental group. So it proves that Apple cider vinegar has significant effect on total serum cholesterol level.

Table 3:-t-test score of serum LDL for experimental and control group, N= 40. (Post test comparison of Experimental and Control group)

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
EXP	LDL	-0.450	18.216	4.073	8.976	8.076	110	19	.003
CONT	LDL								

Table 3:-Depicts that at 5% level of significance the t-test value is 11.1 at degree of freedom 19, which is less than tabled value, so we reject the null hypothesis. Hence the results are significant (p=.0031). It means the serum LDL values decrease after regular consumption of apple cider vinegar in experimental group. So it proves that Apple cider vinegar has significant effect on LDL.

Table 4:-Association between weight, age and height with cholesterol level of subject.

The data presented in **table 4** shows the association between weight, age and height with serum cholesterol level, which were not found to be significant at 5% of level of significance.

Conclusion:-

Angioplasty and various cardiac interventions are available now days to save the life of heart. Unhealthy life style, unhealthy food pattern, sedentary life style is the contributor factors that increase the risk of cardiac disorders. But if one include such supplement in the life style which makes the heart healthy by normalizing the serum cholesterol then life become easier and less risky. So this study proves such a intervention that is apple cider vinegar, which significantly reduces the raised serum cholesterol level. Apple cider Vinegars is known for its best of vinegar as the main effect of it is to help to get rid of the fats around the liver. When it is consumed it has gentle effect on the digestive tract as compared to the other forms of the vinegar. It has also got the special ability to breakdown the fats over a period of time and that will help in easy and healthy functioning of the kidneys bladder and liver. The apple cider vinegar has acidic properties which will reduce the irritability and inflammation of the liver.

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Transparency Declaration:-

This statement is to certify that the author have seen and approved the manuscript. I warrant that the article is the author original work. I warrant that the article has not received any prior publication and is not under consideration for publication elsewhere. I declare that there is no conflict of interest in this study.

Deepak Sethi

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